



A miracle of evolution, the human immune system is not controlled by any central organ. . . . Rather it has developed to function as a kind of biologic democracy, wherein the individual members achieve their ends through an information network of awesome scope.

Peter Jaret, 1986

A Simpler Test for Cervical Cancer

Researchers from The Johns Hopkins University in Baltimore, Maryland, and the University of Zimbabwe in Harare have good news for women in developing nations. According to an article published in the 13 March 1999 issue of *The Lancet*, simply wiping the cervix with a solution of acetic acid (vinegar) and visually inspecting the area can reveal more than 75% of precancerous lesions in cervical tissue. The study was conducted by members of the Cervical Cancer Project of the JHPIEGO (pronounced "ja PIE go") Corporation, an affiliate of Johns Hopkins.

During the test, the examiner swabs the cervix with vinegar and then inspects the area with the naked eye. The vinegar causes precancerous tissue to appear as clearly visible white blotches. The study looked at nearly 11,000 African women between the ages of 25 and 55. The study had two parts. In the first part, nearly 9,000 women were examined by trained nurse-midwives at 15 clinics throughout Zimbabwe. The vinegar test and a standard Pap smear were administered at the same time and the results compared. If the vinegar test yielded an abnormal result, the woman underwent colposcopy (which uses a high-powered magnification device to examine the cervix) to confirm the results. In the second part, an additional 2,200 women received both the vinegar test and a Pap smear as well as colposcopy, regardless of whether their screening results were negative or positive. Because all the women in this phase received colposcopy, the JHPIEGO researchers felt the part two results were more valid than those from part one, and so they based their *Lancet* report on the second set of results.

The part two women also received a human papillomavirus (HPV) screening to determine whether an HPV test would be a useful adjunct to the vinegar test. Nearly all cases of cervical cancer are caused by infection with HPV, which is one of the most common sexually transmitted diseases. (These findings will be published at a later date.)

Among the part two women, who received both screening and colposcopy,

the scientists found that the vinegar test correctly designated more women as having disease than the Pap smear did, identifying nearly 77% of abnormal results as compared to just over 44% for the Pap smear. However, specificity (the proportion of nondiseased women who were accurately assessed during screening as being test-negative) in this part was lower for the vinegar test than for the Pap smear. Only 64% of the women who had been identified as test-negative with the vinegar test were confirmed by subsequent colposcopy to not have precancerous lesions, compared to nearly 91% of the nondiseased women who had been identified as test-negative with the Pap smear. Paul Blumenthal, an associate professor of gynecology and obstetrics at Johns



The acid test. When swabbed with an acetic acid solution (vinegar), the healthy cervix looks pink (left). On the diseased cervix, however, precancerous lesions appear as white blotches (right).

Hopkins and a report coauthor, says improved training in properly identifying suspicious blotches—for instance, being able to distinguish them from signs of infection—may reduce the relatively high number of false positives associated with the vinegar test.

Cervical cancer causes some 200,000 deaths in developing nations each year, as compared to about 5,000 deaths per year in the United States. But according to the *Lancet* article, only about 5% of women in developing nations in Africa, Asia, and Latin America are screened for cervical cancer, versus as many as 70% of women in industrialized nations. Pap smear screening—which involves transportation of specimens, technical training of practitioners, and follow-up on negative results—requires a health care infrastructure that many poorer nations currently lack.

According to the American Medical Women's Association, a national organization of women physicians and medical students, cervical cancer is nearly 100%

curable if precancerous lesions are detected in time. According to the *Lancet* article, however, by the time most women in developing nations seek medical help, they are at an advanced stage of cervical cancer.

Blumenthal believes the vinegar test is advantageous for developing nations. The test is simple to perform, inexpensive, and provides nearly instant feedback. The test has been used by gynecologists for at least 40 years, he says. According to Blumenthal, in the United States the test is usually used as a secondary detection measure as part of the colposcopy process. But in developing nations, the test may soon become a first line of defense against cervical cancer.

The article notes that there are costs to both the patient and the health care system involved in false positive results. Blumenthal says JHPIEGO will undertake several medium- to large-scale projects within the next few years that will look at issues of safety, feasibility, and the willingness of local patients and practitioners to accept both the test itself and subsequent immediate treatment. He says, "With a test-and-treat approach, you're going to screen a lot of women who have never been screened before, and most likely you're going to find a lot of disease." The question is whether

local medical infrastructures will be able to support the treatment services necessary for dealing with all the new cases.

The Shape of Hemes to Come

By describing the three-dimensional shape of protein functional groups called hemes, John Shelnutt, a member of the technical staff at Sandia National Laboratories and a professor of chemistry at the University of New Mexico in Albuquerque, and his colleagues have opened a new window into the world of molecular biology. Their research suggests a new way to identify the function of many of the molecules most essential to life—molecules that break down pollutants, carry oxygen, sense diatomic molecules, and metabolize drugs and toxicants. Their findings could have important implications for medical science sensor technology and waste remediation techniques.

Hemes serve as the docking and chemical activation sites for other molecules on proteins such as hemoglobin, cytochromes,

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